**WATER RESOURCES RESEARCH GRANT PROPOSAL**

**Project ID:** 2005IN174B

**Title:** Rapid Detection of Toxic and Taste and Odor Causing Cyanobacteria in Indiana Surface Water

**Project Type:** Research

**Focus Categories:** Surface Water, Toxic Substances, Water Quality

**Keywords:** Cylindrospemopis raciborskii, Pseudanabaena limnetica, blue-green algae, toxic algae, harmful algal blooms, cyanobacterial DNA, PCR, 5'-exonuclease PCR, detection methods

**Start Date:** 05/15/2005

**End Date:** 01/30/2006

**Federal Funds:** $20,000

**Non-Federal Matching Funds:** $40,000

**Congressional District:** 4th

**Principal Investigator:**
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## Abstract

Invasive, non-native species cause serious environmental degradation in both terrestrial and aquatic habitats. Invasive species of cyanobacteria (or blue-green algae; common constituents of HABs [harmful algal blooms]) have appeared recently in Indiana's surface waters. These include Cylindrospermopsis raciborskii, a toxin-producer first detected in 2001 in Ball Lake (Steuben Co.) and in Eagle Creek Reservoir, a major drinking water supply reservoir for Indianapolis, and Pseudanabaena limnetica, which causes taste and odor problems in drinking water reservoirs and first appeared in Indiana in 1989. These organisms currently are controlled in the U.S. using large-scale copper treatments of the water bodies or implementing expensive removal processes at the water treatment plant. These measures tend to be taken only after large concentrations of the organisms have appeared, primarily because it is difficult to identify these two species with the light microscope (particularly when populations are still low), few people have the technical capability to make accurate identifications, and because there can be a considerable time lag between water sample collection and actual identification. This delay results in larger quantities of copper (a heavy metal with potentially adverse

environmental consequences) being used for control, which can result in the release of toxic or taste and odor compounds into the water causing a spike in levels and the development of cyanobacterial resistance to copper. At the water treatment plant, greater cyanobacterial populations increase the expense of treatment and threaten to overwhelm removal capabilities. Our goal is to develop a molecular detection method that is specific to these two species, is sensitive at low cell concentrations, is rapid, and is relatively economical. Although PCR has been used to amplify cyanobacterial DNA, and specific primers have been created to detect certain species in water, these techniques are qualitative, not quantitative. We propose developing a quantitative detection method using 5'-exonuclease PCR, which measures the release of a fluorescent dye in response to amplification of a specific target sequence. A properly developed and calibrated assay will allow the quantitative determination of the cyanobacterial cell concentration. This technique has been widely used in medical research but has seen only limited use in environmental analysis. The successful development of this technology to rapidly detect and monitor small numbers of cells before they reach peak populations has the potential to improve the management of cyanobacteria and other HABs not only locally but nationally, and even globally.